DNA Sensor Based on the Modified Nitrogen-Doped Nanocrystalline Diamond Film

Zhenqing Xu[1, 2], Arun Kumar[2], Monoj Singh[2] Ashok Kumar[1, 2], and Sathyaharish Jeedigunta[1]
[1]Department of Mechanical Engineering, University of South Florida, Tampa, FL, 33620, USA
[2]Nanomaterials and Nanomanufacturing Research Center, Tampa, FL, 33620, USA

In this paper, we study the immobilization of DNA on the conductive polymer modified nitrogen-doped nanocrystalline diamond (NCD) thin films for DNA hybridization analysis. Diamond is an idea platform for biosensors because of its superior mechanical, thermal, chemical and electrical properties. The NCD has been grown on silicon substrates by microwave plasma enhanced chemical vapor deposition (MPECVD). Up to 20% nitrogen gas was added to reactants during the deposition to dope the NCD film. A thin layer of conductive polymer has been electrochemically deposited onto the diamond surface. The carboxylic acid residues in the polymer film act as the binding sites for DNA attachment, the conductive polymer enhanced the electron transfer between DNA and the diamond surface. The immobilization of the DNA and the following target hybridization are monitored by electrochemistry measurement and FTIR Spectroscopy (Fourier Transform Infrared). This approach could make the conductive polymer modified nanocrystalline diamond film as a stable and highly selective platform for DNA sensing.

Keywords: DNA, Nanocrystalline diamond film, CVD, Conductive polymer